ENSO-Related Precipitation Anomalies & Water Quality in Clarlotte

Research Summary

Seasonal variation in temperature and rainfall affect the transport and survival of organisms associated with fecal pollution such as fecal coliform bacteria, enterococci, C. perfringens, and coliphage, *Cryptosporidium* spp. and *Giardia* spp. The monies from this grant were used to increase understanding of the relationship between seasonal variation in environmental variables (rainfall, temperature, riverine discharge and salinity) and variation in number of fecal indicators found in the water column and sediments in a south Florida estuary.

Funds from the NOAA Climate Variability and Health Program, in conjunction with monies from the Florida Department of Health, supported the first major study of the distribution and seasonal changes in microbial indicators and enteric pathogens within the Charlotte Harbor estuary. The Charlotte Harbor estuary is the second largest estuary in Florida and receives freshwater drainage from over 7,200 km^2 of southwest Florida. The estuary supports recreational use, shellfish harvesting and residential drainage. Each of these activities may effect and are affected by the incidence of fecal pollution.

Temporal and spatial classification of the occurrence of indicator organisms compared with variations in environmental conditions revealed relationships between high levels of fecal indicators and wet weather events. Specifically, sampling events during high levels of freshwater input, and thus lower salinity, were correlated with higher levels of fecal indicators. Also, collection sites located near streams flowing from catchments containing high densities of on-site sewage disposal system (OSDS) tended to have higher levels of indicator organisms.

Precipitation and river discharges during this study followed patterns typical of strong El Niño ENSO events; heavy rainfall and peak streamflow occurred in the late fall and winter months. Increased rainfall, discharge and streamflow were all positively correlated with the occurrence of fecal coliform bacteria, while temperature and salinity were negatively related to fecal coliform levels in water and sediments. Concentrations of fecal indicator bacteria, enterococci and coliphage varied across months and the highest concentrations typically occurred from December through February. Levels of infectious enteroviruses were seasonally dependant (detected only during the winter months) and displayed relationships to changes in local weather. Meanwhile, *Cryptosporidium* and *Giardia* were found in 25% of samples over the entire sampling period, with no observed correlation with weather patterns.

Using a unique binary logistic regression model enteroviruses presence was related to occurrence of fecal coliform bacteria, enterococci and coliphage. However, using the same model, there was no such relationship between enteric pathogens, *Cryptosporidium* and *Giardia,* and microbial indicators. Also, enterovirus occurrence was predicted in 93.7% of the cases when temperature and rainfall were used as correlates in the model. Given the relationship between enteroviruses and occurrence of microbial indicators, this

model may serve as a predictive tool for incidents of poor water quality when temperature and rainfall data is readily available.

- Lipp, E.K., R. Kurz, R. Vincent and C. Rodriguez-Palacios, S.R. Farrah and J.B. Rose. 2001.. The effects of seasonal variability and weather on microbial fecal pollution and enteric pathogens in a subtropical estuary. Estuaries. 24: 266-276

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